STCG Management Council Meeting

July 18, 2001

EESB Snoqualmie Room

Challenge Area Workshop: Surface Barrier Implementation

Welcome/Announcements/Routine Business **Paul Kruger/Marcus Glasper**

Marcus Glasper opened the meeting and everyone made introductions around the room. He then introduced Paul Kruger and Terry Walton as co-chairs of the STCG Management Council. Bryan Foley was introduced as the Chair of this Surface Barrier Implementation Workshop.

Paul Kruger made some opening remarks, commenting that it was great to have standing room only at the workshop. He suspected that the crowd was there because of the "meaty" topics on the agenda. It was decided at the last Management Council meeting to center future meetings on the 11 grand challenges outlined in the February 2001 *Hanford Site Cleanup Challenges and Opportunities for Science and Technology – A strategic Assessment*. This workshop was the first in the series. He thanked the folks involved in putting this meeting together.

Paul covered some administrative items relevant to the STCG. Recently there was an RL reorganization, and we now have an Assistant Manager (AM) for the Central Plateau (Pete Knollmeyer) and an AM for the River Corridor (Beth Bilson). The Site is now more focused on the three outcomes (i.e., The River, The Plateau, and The Future) that were presented in *Hanford 2012: Accelerating Cleanup and Shrinking the* Site (published in January 2001). RL has recently developed a draft Strategic Plan, which is currently undergoing internal reviews. It will be distributed to the regulators and stakeholders for review and comment.

There is good news in budget arena. The OST budget came back in excess of $271M in the Senate; the House is at $226M. The request was $191M. RL is working with HQ and the Focus Areas to develop S&T roadmaps. The first one is a roadmap for the groundwater remediation element of the Groundwater/Vadose Zone Integration Project. Several Focus Areas want to do S&T needs workshops at Hanford this fall.

The Tanks Focus Area (TFA) is currently undergoing an audit by the Inspector General's Office to determine whether they are meeting the needs of the Department. There is no feedback yet, but we believe that the TFA is working well and we don't expect any significant findings.

Paul introduced Mike Schlender, the Deputy Manager for Site Transition. Mike noted that the STCG has been doing wonderful things and that Paul Kruger and Terry Walton have done a great job. RL needs the support of its regulators and stakeholders and the local Tribal Nations to solve its cleanup problems.

Marcus Glasper provided some background that went into planning this workshop. At the last two meetings, we had an explanation of the 11 Site S&T challenge areas. We proposed a new approach of using those challenge areas to focus a series of STCG technical workshops. We took input from STCG Management Council members and ranked the challenges. In the ranking, Groundwater Remediation actually came out on top. However, because we already had some workshop planning efforts underway on surface barriers, we decided to do that one first. The 11 challenges were ranked (along with three additional topics that the members wrote onto their ballots) in the following order (scores are in parentheses):

1. Groundwater Remediation (104)
2. Surface Barrier Implementation (102)
3. Retrieval of Remote-Handled Waste (70)
4. Groundwater/Vadose Zone Phenomenology (62)
5. RH-TRU Handling and Disposition (48)
6. Highly Contaminated Facilities Deactivation and Decommissioning (30)
7. Subsurface Soil Access (28)
8. Canyon Disposition (26)
9. Integration with ORP (24)
10. Nuclear Material Management (14)
11. Tank Waste Retrieval (10)
12. Overall Process (8)
13. Institutional Controls (6)
14. Final Reactor Disposition (0)

We drafted generic objectives to make sure these workshops would be beneficial to the RL programs and the STCG membership. Each challenge area will also have its own specific objectives. These following objectives were used by Bryan Foley to plan this workshop. We encourage your feedback on these objectives.

Draft STCG Workshop Objectives:

- Advance the collective understanding of key technical challenges at Hanford.
- Understand values and key issues of regulators, tribes, and other interested stakeholders.
- Explore opportunities to address the challenge at Hanford.
- Establish a path forward to accomplish the purpose and objective of each workshop.

Linda Fassbender reviewed the workshop agenda.

Overview/Purpose/Objectives **George Sanders (for Pete Knollmeyer)**

Bryan Foley introduced George Sanders, who spoke on behalf of Pete Knollmeyer. He expressed how important the surface barrier work is. We need barriers for closure, but we also have a lot of interim activities that need barriers. We are always going to face funding challenges, so we need to keep an eye on the cost-effectiveness of the technology. We need to understand when the technology will be needed. We also need barrier technology that can be adapted ("one size does not fit all").

Significance of the Challenge Area

Hanford Planning - Bryan Foley (RL)

One of the key things that needed to happen for this workshop to be successful is to get an integrated group of people to address this challenge area from a single, strategic perspective. Using the Hanford S&T Assessment document, Bryan developed the following statement of the workshop purpose:

> "Establish an integrated group of DOE end-users who will work in consultation with regulators, tribes, and other interested stakeholders to provide a single, strategic perspective on the implementation of surface barriers at Hanford."

The objectives of this workshop were to:

- Advance the collective understanding of key technical challenges associated with surface barrier implementation at Hanford.
- Understand the values and key issues of the regulators, tribes, and other interested stakeholders (trying to get a collective understanding on the key issues associated with surface barriers).
- Explore opportunities to address the surface barrier implementation challenge at Hanford (brainstorming session).
- Establish a path forward to accomplish the purpose and objectives.

Questions/Comments:

Dennis Faulk: He disagrees with the purpose statement. If it's a consultation effort, we are going to fail. It must be a partnership with the regulators and stakeholders or it will not work. Bryan agreed to change the purpose statement.

Mike Schlender: We are truly bringing together a partnership with this remedial action system. Mike wants to hear more about any concerns the STCG members may have. This is a strategic effort, not a short-term activity.

Dennis Faulk: A lot of surface barrier work was done at Hanford in the past, and it should be captured in this current effort.

Scott McMullin: We are trying to start from the historical perspective.

Wade Riggsbee: Hanford had lots of international experts on surface barriers in the past. Don't forget that work.

Terry Walton: This workshop is a pilot. The failure mode is if everyone leaves here saying, "that's not what I wanted to hear." People should speak up at anytime, even if we have to change the agenda.

Bryan Foley: Posted around the room are different pieces of Hanford planning documents developed by BHI and FH. The Hanford cleanup summary schedule shows River Corridor closure. The ERDF and Central Plateau Master Schedule shows a rollup of key activities for different facilities and TPA milestones associated with them. There are blowups of the 200-E and 200-W Areas showing the tank farms and key landmarks.

Mike Schlender: Mike is currently leading a parallel effort to capture and consolidate work plans for the Central Plateau. Most of the challenges before us are in the Central Plateau. More definition is needed on what needs to be done. They are continuing to refine their products, and this workshop will help.

Bryan Foley: In the soil remediation area, significant remediation planning is taking place (2007-2008 time frame). It's not too soon to start talking about surface barriers.

Hanford Planning - Bob Lober (ORP)

Bob discussed surface barrier use for SST retrieval and closure. The ORP Retrieval Program has assessed interim surface barriers to support sluicing of SSTs. They have funding for surface barriers in their baseline right now, and they are developing risk-based SST retrieval plans.

Recently, TPA milestones for retrieval and closure were renegotiated, which changes the near-term schedule through 2006. The ORP Retrieval Program is exploring low-volume retrieval technologies that will reduce the need for interim surface barriers. There is also a need for reactive barriers as a leak mitigation step.

Technical Challenge - Mike Fayer (PNNL)

Mike was speaking for Glendon Gee (PNNL) regarding functional performance of surface barriers. Glendon and Jerry Cammann (CHG) worked for over eight years on barriers. Technical challenges have been identified by both SCFA and Hanford. A key cost-saving measure identified by SCFA is development of risk-based cover systems tailored to specific waste sites.

Potential barrier functions:

- Limit water infiltration (<0.5 mm/yr)
- Resist plant and animal intrusion
- Limit inadvertent human intrusion
- Limit erosion by wind and water
- Limit emissions of noxious gases
- Maintain functionality for specified design life (from interim to 1,000 years)

SCFA has sponsored a series of workshops:

- Risk-based cover system development
- Performance criteria
- Prevention and mitigation of failures
- Performance modeling

- Existing barrier systems data review
- Natural analogs
- Long-term processes (environmental envelope)
- Regulatory coordination/interface (a key challenge identified at the national level)

Environmental Envelope
- Climate (averages and extremes)
- Soils
- Vegetation
- Animals
- Episodic and seismic events (fire, drought, flood, earthquake)
- Geomorphology
- Geohydrology
- Long-Term Changes (pedogenesis, ecological succession, climate)

Challenges at Hanford
- Full-scale performance testing of modified RCRA C design (preferred for 90% of area at Hanford) – highest priority
- Design optimization tool to address performance, materials, and barrier dimensions to allow graded barrier approach
- Hydrologic and stability evaluations of sideslope designs and alternatives
- Long-term monitoring methods – prototype barrier is heavily instrumented with a series of access ports into it and is very complex. Some have to remain and carry forward to stewardship and be a factor in cost.
- Longevity evaluation of asphalt layer

Additional Challenges at Hanford
- Material availability
- Coordinating covers in complex environments (runoff onto adjacent sites)
- Minimum thickness requirements
- Model verification
- Subsidence
- Fire effects
- Sand dunes
- Human intrusion scenarios

The next step is to solicit more challenges and add them to this list.

Questions/Comments:

Wade Riggsbee: What about conscious intrusion into waste sites?

Scott McMullin – SCFA is addressing potential intrusion. Long-term changes of the physical environment are critical factors. The highest priority for SCFA is full-scale performance testing of the modified RCRA C barrier design. Next is a design optimization tool to address

performance, materials, and barrier dimensions to allow a graded approach. Monitoring is the major cost of long-term stewardship.

Dirk Dunning: Horizontal transport of water under the waste sites could be a huge problem. The cover areas are not just the waste site dimensions plus 10%. We may need one huge cap for the entire 200 Area! There's also a need to put in vertical cutoffs to prevent sideways infiltration. Mike: It's not clear; we don't know if this is true all over the Site. The Hanford barrier does not measure horizontal flow.

Wade Riggsbee: We may need to cut a trench into the barrier to check its performance compared to the monitoring technology.

Alisa Huckaby: What about all the subsurface piping and equipment under the tanks? The tank farms have miles of subsurface conduit and piping, and we're not sure where it is. How do you cover something so complex? It's not neat and tidy like putting covers on cribs. We need a systems look at tank form closure (e.g., ancillary piping and equipment). It may drive the S&T needs process.

Terry Walton: What is the basis for the water infiltration rates? Mike: It depends on what you're trying to cover. 0.5mm per year is the design goal. There is nothing that looks at lateral flow on a large scale. We need to look at analogs on Site. Some of our studies have looked at piping in the tank farms.

Planned Approach for 200-Area Soil Sites – Bruce Ford (BHI)

Bruce is involved in planning exercises for the 200-Area soil sites. Different barrier designs are required for different types of waste sites (e.g., TRU, mixed LLW, non-hazardous LLW). Resolution of long-term issues (e.g., subsidence) is a key concern. Feasibility studies will be completed in 2001, and remediation will start in 2008. Their vision is to do a full-scale treatability test of a Modified RCRA C Barrier. The path forward is already scheduled.

Graded Approach to Barrier Designs:

- Focused feasibility study of engineered barriers issued 8/96 – the Hanford barrier, a modified RCRA C barrier, and a modified RCRA D barrier were included
- Feasibility Study included a seven-step process
  - Definition of waste site categories
  - Identification of ARARs
  - Establishment of conceptual design criteria
  - Preliminary selection of cover types
  - Preparation of generic conceptual designs
  - Detailed evaluation
  - Regulator buy-in

200-Area Soil Site Barrier Needs:

- Waste Site categories and barrier types
  - TRU Sites – Hanford Barrier

    - Mixed LLW Sites – Modified RCRA C Barrier
    - Nonhazardous LLW Sites – Modified RCRA D Barrier
- Current baseline assumes over 200 barriers covering more than 800 acres

Challenges:

- Field-scale performance data to demonstrate barrier performance
    - Graded barrier designs
    - Longer-term performance data sets
    - Better performance monitoring technologies
- Resolution of outstanding technical issues
    - Design: calibrated models, hydrologic breakthrough, water control, steep side-slope stability
    - Implementability: material availability and potential environmental impacts
    - Long-term performance: asphalt/geomembrane durability, climate change, fire impacts, intrusion, sand dune formation, vegetation change, extrapolation of short-term data for long-term predictions
    - Settlement/Subsidence: solid waste burial grounds, sites with void spaces

Timing, Vision, and Path Forward:

- Timing: First feasibility study (beginning in 2001) will lead to RCRA decision; remediation starting in 2008.
- Vision: Perform full-scale treatability test of modified RCRA C barrier; continue prototype Hanford barrier performance monitoring
- Path Forward: Material availability study – 2001; Design – 2002-2003; Construction – 2003-2004; Performance monitoring – 2004-2006; Treatability test report - 2007

<u>Planned Approach for Vadose Zone Characterization Project – Tony Knepp (CHG)</u>

What interim barriers are needed in the tank farms? We need to characterize what's leaked and then look at what can be done. Tony's group spends one-third of their time collecting new data, one-third colleting old data, and one-third doing something with the data. There are problems going into the tank farms to collect data, partly because people still work there. Numerous preliminary actions must be taken, such as:

- Cutting off all the water lines that are no longer needed, since they all leak. Any used water lines are pressure tested.
- Controlling run-on in the farms. There has been flooding in the T farm and the S farm. Water lines are continually breaking and being repaired. They use run-on control barriers so the farms are protected. Can they control water being infiltrated into the farm?

The tank farms represent unique areas to be covered. Next fiscal year, they will begin to make an estimate of what requirements must be met in order to put an interim barrier on the farms. Are interim barriers needed in the tank farms? Is it worthwhile to install them? It depends on the RCRA risk assessments. Interim barriers cannot interfere with the final barriers. They will identify all requirements and constraints that must e dealt with. There is currently no commitment to put barriers on the farms.

Alisa Huckaby: Barriers are in the baseline. It should be emphasized that the previous presentation is about interim barriers. Tony: One of the constraints is to not interfere with the permanent solution.

Planned Approach for Canyon Disposition Initiative - Gary McFarlan (BHI)

The goal of CDI is to provide a "strategic decision" for the permanent disposition of five chemical processing plants in the 200 Area.

Current Status:

- Three of the five alternatives evaluated require the use of a surface barrier.
- Barrier implementation will be required with the next 10 years.

Alternative 4 (leave canyon in place) requires a barrier 80 feet high.

- Looked at stability under a 6.5 earthquake.
- At a 2% slope, the barrier would reach from Ellensburg to Walla Walla.
- 1.7 million cubic yards (800 cubic yards of waste volume).

Engineered barrier:

- Evaluated four barrier designs – Hanford Site Barrier, Standard RCRA Subtitle C Barrier, Modified RCRA Subtitle D Barrier, and Modified RCRA Subtitle C Barrier

Slope Stability – Design Criteria

- Design life – 1000 years
- Evaluate environmental cap for performance category 3 seismic event with site-specific design factors.
- Assumed engineered barrier replacement at 500 years.
- Select materials of construction that require minimum maintenance (asphalt and geosynthetics not used).
- Maintain integrity of engineered barrier over the waste.
- Small, non-penetrating deformations within silt layers are acceptable.

Conclusion: Although CDI's goal is not to solve all the questions associated with surface barrier planning at Hanford, it is at the forefront of barrier technology needs and implementation.

Questions/Comments:

Craig Cameron: What drives your earthquake level? Gary: We used a Hanford document that gave seismic and other design criteria for Hanford facilities.

Dirk Dunning: Are you using new seismic data or old? Gary: The document was published in 1997, so it's relatively new data.

Gary: This is a great group – we are looking for your help.

Complex-Wide Perspective **Scott McMullin (SCFA)**

Scott McMullin is from the Subsurface Contaminants Focus Area (SCFA) at the Savannah River Site. He presented SCFA's long-term capping strategy and technical program. There are 150 acres of RCRA C barrier installed at the Savannah River Site. There is a need for integration between the scientists and engineers at all the sites so they can learn what's going on at other sites.

The ideal goal of "pristine cleanup" is prohibitively expensive. A more realistic focus is containment, groundwater controls, site closure, and long-term stewardship. Hanford has time to learn from what is happening at other sites. We are moving from an ideal situation to an achievable situation. It is an issue of risk management. SCFA is managing the risks across the DOE Complex to optimize funding and still protect the environment and the health and safety of the workers and the public.

SR has an alternative landfill cover using geosynthetics. Fernald has a modified landfill cover and is looking at material performance issues. Sandia has four covers. We have some very important, excellent work that was done right here. We can't afford to build new test facilities over and over again. We need to capitalize on what's already been done, then go further. Design life will be commensurate with the type of waste you're protecting. We need to verify and monitor performance to build a database on how well existing surface barriers are performing. Hanford can benefit from the work that is being done today. You don't have to start at the beginning.

Questions/Comments:

Dirk Dunning: Are you doing monitoring for contaminants of the vadose zone?
Scott: Most of the sites are monitoring; they are depending on the Groundwater/Vadose Zone Program to monitor.

Current S&T Needs/Gaps

<u>Subcon and D&D Subgroups - Scott Petersen (BHI)</u>

There is a suite of surface barrier needs that fall under SCFA. We use these needs to communicate our priorities to others and to focus our internal efforts.

List of SCFA surface barrier needs:

- RR-SS17 – Long-Life Waste Isolation Surface Barrier
- RL-SS27 – Use of Field Data from Representative Sites to Elucidate Controlling Features and Processes for Contaminant Distribution
- RL-SS28 – Understand, Quantify and Develop Descriptions of Reactions and Interactions between Contaminants of Concern and Vadose Zone Sediments
- RL-SS29 – Develop Descriptions of Contaminant Flow and Transport in the Vadose Zone

- RL-SS30 – Understand and Quantify Water Movement in the Vadose Zone Using Uncontaminated Field Sites
- RL-SS31 – Provide Advanced Characterization Tools and Methods to Delineate Contaminant Plumes in the Vadose Zone and Relate Plume Distribution to the Distribution of Geochemical and Hydrogeological Properties

There is one D&D surface barrier need:

- RL-DD051 – High-Profile Surface Barrier for CDI

Tanks Subgroup - Ken Gasper (CHG)

ORP's surface barrier S&T needs relate to SST interim closure. The near-term needs are associated with the Groundwater/Vadose Zone Integration Project. Longer-term needs focus on tank closure and immobilized low-activity waste (ILAW) disposal. Jerry Cammann and Fred Mann presented the following needs:

- RL-WT017 – Long-Term Testing of Surface Barrier
- RL-WT035-S – Moisture Flow and Contaminant Transport in Arid Conditions
- RL-WT044-S – Distribution of Recharge Rates
- RL-WT061 – Reactive Barriers to Contaminant Migration
- RL-WT046-S – Getter Materials
- RL-WT053-S – Contaminant Mobility Beneath Tank Farms
- RL-WT063 – PHMC Retrieval and Closure – Hanford SST Saltcake Dissolution Retrieval
- RL-WT076-S – Plutonium Interaction with Silicates

Tanks - Jerry Cammann (CHG)

In the past, Jerry managed the Hanford Protective Barrier Program for 7-8 years, working with 25 scientists and engineers at Hanford and across the nation. Our surface barrier needs focus on single-shell and double-shell tank retrieval and closure activities. We must approach closure from a systematic perspective. In future meetings, we need to expand into subsidence issues. We need to leverage work going on across the DOE Complex.

We are looking at improved tank leak detection technologies. These technologies could be used later for monitoring barrier performance. Several technologies will be demonstrated in the 200 Area this summer. We will also do bench-scale testing of reactive barriers to stop the movement of technetium, including the apatite barrier that Sandia is working on.

Tanks - Fred Mann (CHG)

The Groundwater/Vadose Zone Project identified surface barriers as the #1 Hanford Site technology need. The #1 science need was also associated with barriers.

The ILAW Program has science needs as part of the system design. Often we think of S&T being done by specialists outside the project. However, projects on Site are doing a lot of S&T activities within their work scope.

TRU-Mixed Waste Subgroup – Kevin Leary (RL)

The TRU-Mixed Waste Subgroup has not yet developed a formal surface barrier technology need, but they plan to do so. If Hanford develops a surface barrier S&T roadmap, we should incorporate lessons learned from other sites around the Complex.

Background:

- Currently there are two mixed waste lined trenches and one unlined trench
- Trenches are double-lined with a leachate collection and removal system

TMWFA Barrier Design Objectives:

- Comply with RCRA
- Maximize protection of human health/surrounding environment and concurrently minimize costs
- Meet regulatory design life
- Prevent or minimize water from percolating into the waste and forming leachate
- Minimize erosion, intrusion, soil piping and frost heave
- Maximize longevity of clusre cover (500 to 1000 years)
- Minimize barrier maintenance
- Design a barrier conducive to long-term vadose zone monitoring to demonstrate barrier performance

TMWFA Barrier Technology Needs/Philosophy:

- Apply creative thinking for barrier design
- Avoid re-inventing the wheel: use existing data and build upon it
- Utilize more small-scale physical models/bench-scale tests of new barrier designs prior to pilot tests or actual field-scale deployment
- Capture, share, and implement on and off-site "lessons learned"
- Teamwork: look for opportunities to cooperatively work for and with other DOE sites
- Prior to barrier deployment, demonstrate barrier performance/validation for regulatory and stakeholder acceptability
- Assemble inter-disciplinary team for barrier research and development, final barrier design, and technical peer review of barrier design.

Related TTPs Currently Funded **Andy Ward (PNNL)**

Development of Enhanced Moisture Sensing and Cover Performance-Hanford Surface Barrier

Background: We are focusing on longer-term data to demonstrate performance and robust, long-lived monitoring technologies.

Traditional moisture monitoring:

- Most modern caps have existed for less than 10 years and have been monitored for much less than that.

- They typically include sensors within and/or beneath the cover that provide "point" measurements.
- Operational life of in-place sensors is unknown, but probably on the order of 10s of years.
- Abandonment and deterioration can provide an avenue for cover compromise.
- Measurement error often exceeds hydrologic performance criteria.

Objective- Identify, demonstrate, and evaluate advanced technologies for reliable and cost-effective monitoring of hydrologic performance:

- Ground-penetrating radar
- Electromagnetic induction
- Profiling TDR

Prototype Hanford Barrier:

- Ideal test bed for monitoring technologies
- 2.5 ha vegetated capillary barrier
- Only field-scale comparison of side-slope designs
- Systems for monitoring water and energy balances
- Surface and slope stability
- Plant population dynamics

Advantages and Cost/Benefit:

- No need for sensors within and/or beneath the cover
- Abandonment, deterioration or operational life no longer important issues
- Provides information at a larger scale, eliminating interpolation error
- Significant cost savings from using existing test bed
- Extends data baseline for field-scale performance
- Helps to establish cost basis and protocol for long-term stewardship

Perspectives/Issues/Experience

Dib Goswami (Ecology)

The surface barrier is supposed to be an environmentally safe and maintenance-free permanent isolation barrier that will control the following elements for a very long period of time:

- Water infiltration
- Plant and animal intrusion
- Wind and water erosion
- Inadvertent human intrusion

The role of science and technology was to provide proof of permanency and isolation. Lateral migration is a key issue. We need to do more information sharing with other DOE sites to make better decisions for Hanford.

Evaluation:

- Engineering evaluation – design and construction
- Long-term performance test/results
- Uncertainties

Results will determine its application as the remedial option.

Issues:

- Basic conceptual model
- Testing results
- Barrier performance through vadose zone monitoring
- Information sharing with other DOE sites
- Uncertainties
- Modeling results
- Risk assessment
- Future land use
- Tribal nations, public and stakeholder issues (e.g., impacts on cultural resources)
- Cost
- Long-term stewardship

Possible Multiple Application:

- Tank sites/closure
- Low-level waste burial grounds
- Cribs/ponds and ditches
- Canyon facilities
- Others

Current Program at the Hanford Site:

- Ecology supports the Hanford Prototype Barrier concept.
- We need more information on monitoring and performance data.
- Inadequate funding is a big issue.
- Other alternative barriers/covers should be investigated.

ITRC activity (Ecology/Western Governors Association)

- Looking at alternative landfill covers such as vegetative covers
- Dib Goswami is the Washington State Team Lead for the ITRC Phytotechnology Team.

Dennis Faulk (EPA)

It's time to get on with it and build some barriers. We've been talking about it long enough. BHI has already developed a schedule that meets EPA's requirements. We have continued to collect data on the Hanford barrier, but we don't sit down and talk about it very often. We need to have that meeting. Dennis thinks the Hanford barrier is the Rolls Royce model and we can't afford to build very many of them.

We should review the Sandia document on alternative barrier types: Innovative Technology Summary Report (DOE-EM-0558). We also need to think about long-term monitoring after 150-300 years, when we've lost institutional control. It's not realistic to think that we will replace the barrier after 500 years.

Wade Riggsbee (Yakama Indian Nation)

Wade sees an issue with closure integration and barrier design. If you're going to start making decisions on endstates, you need to integrate information from RL and ORP. You also need to elevate some of the historical problems in monitoring the barrier. We should bring in outside engineering design people to "pick their brains" and get the national-level perspective from them. We also need to review the lessons learned from other sites. There is an opportunity to get our S&T needs into the SCFA guidance document that is now under development.

In the last few months, meetings were held with leaders of the government of the Yakama Nation. They have a problem with leaving waste on site. In the past, they took the stance that all waste should be cleaned up and removed. Realistically, they now realize that some waste is going to be left on Site with engineered protection by surface barriers.

Judit German-Heins (Nez Perce Tribe)

The original mission of the Tribes was to restore Hanford to its original pristine condition. Now they are starting to realize that this is not feasible or possible in all cases. They are now focused on protecting the river. It's really important to reduce the chance of future contamination of the groundwater. The results show that the prototype barrier developed here at Hanford has a lot of potential. It has advantages over RCRA caps.

The Nez Perce Tribe has several issues:

- They don't know enough about the vadose zone and the extent of contamination.
- They are concerned about the structural integrity of the barrier in the event of a big earthquake in the Cascades.
- Models are based on historical data, but not 300-year data. The barrier needs to be evaluated for a longer term.
- They understand that the implementation of this barrier is very expensive. They would like to start today to allocate financial resources for future barrier implementation.

Dirk Dunning (Oregon Office of Energy)

Dirk is speaking for himself and not for the Oregon Office of Energy. Oregon's primary concern is shared use of the river in the long term. Site waste management is a Washington issue. Engineering of barriers must adapt to correct past failures.

Issues and Concerns:

- Given the layered structure of the Hanford soils, horizontal transport is very likely to occur. Barriers may not be protecting the waste if water is moving horizontally.

- Clastic dykes exist in a network across the Hanford Site. These are massive structures that have a tendency to shift horizontal transport to vertical transport.
- There are preferential pathways because the groundwater profile varies with depth. It doesn't appear to be moving as a whole (i.e., the top layer doesn't move with the bottom layer).
- Subsidence and dry-out could result from irrigated farming in the southern half of the Site, which would change the groundwater flow patterns.
- People tend to build houses on hills. Would they build on top of the CDI caps? Or dig into them?
- Intrusion by animals, insects, and plants. The first 1000-year barrier was put in place in Lakeview, Oregon, and a badger dug a hole in it. Cows saw grass on the barrier and went up on the barrier and started eating one edge of the barrier. The rest of the barrier was covered with rock; however, the specification was not complied with and the rock is breaking up. The best estimate is that the barrier will have to be replaced in 200 years.
- Potential for lost institutional controls.

Gordon Rogers (HAB)

Gordon holds a "public-at-large" seat on the Hanford Advisory Board, but he speaks for himself and not for the HAB. He thinks the HAB recognizes the serious need for barriers and caps on the Hanford Site. Individual members may have concerns with it. He is personally very interested in this topic and very supportive of it. His advice is to get on with the barrier construction and monitoring efforts and develop alternative S&T approaches.

Current Initiatives Addressing the Challenge

HQ Initiative: Long-Term Capping Design Guidance Document - Scott McMullin (SCFA)

As we do technology development, an activity creates either a "widget" or a process. There is nothing wrong with state-of-the-art knowledge of surface barriers. The ultimate end user of the information is the person making technical decision. We have formed a technical team to assist these decision-makers/end-users. The team is composed of representatives from Brookhaven National Laboratory, Pacific Northwest National Laboratory, Sandia National Laboratories, Desert Research Institute, Bechtel (Nevada and Hanford), Fluor Fernald, MacTec, Grand Junction Office, and Savannah River Technology Center.

Jim Honeyman: The barrier over the Hanford tank farms is different than other caps. SCFA was asked to take this on for the Tanks Focus Area. ORP (Rob Yasek) is going to be a part of the SCFA User Steering Group along with Mike Thompson. SCFA is looking for stakeholder and regulator input.

Long-Term Capping Design Guidance Outline
- Collaborative development effort between end users/designers and researchers
- Incorporates technical, stakeholder, and regulatory input
- Highlights parametric boundary conditions to influence the design process

When it comes to capping in the DOE Complex, your end point may be totally different from another site's. There isn't one solution for all problems.

Long-term stewardship:

- Technical performance – components, overall system, requirements, monitoring
- System equilibrium – installation and sustained operation
- External Influences – ecological setting, climatic conditions, geological conditions

Scott provided a functional idea of where we are today. Proposals were received from the sites, peer-reviewed, ranked, and awarded. Current TTPs are funded under each of the following areas: engineering design, performance and risk assessment, environmental setting, and verification/ monitoring/stewardship. The work is mostly being performed in the West. We have been criticized that they we have not funded more in the East. There is an integrated schedule for all these projects. The environmental setting side is a little weak.

Long-Term Performance Issues:

- Science development activities transitioning to engineering application
- Long- term performance projection using surrogates – analog studies
- Integration of verification and monitoring techniques
- Overall remedial system performance
- Remedial system performance coupled to risk management projections

We are moving forward right now. It looks hopeful that we'll have funding in the out-years to continue this work. We are getting help from DOE-RL and EPA supporting funding, and would like to see that continue.

Questions/Comments:

Jerry Cammann: Hanford could provide insight into longer-term issues because we have already done a number of these studies. The barrier design requirement used to be 10,000 years, with 150 years of institutional controls. Be sure to look at this past work.

Wade Riggsbee: Subsidence is still a key issue.

Scott McMullin: One TTP is funded now to study subsidence after digging up an old burial ground.. Also, work has been proposed by Nevada covering that issue. A key question is if subsidence occurs, how do you fix it? There is a new activity on seismic qualification. The SCFA website has 15 years of technical documents.

Jerry Cammann: There are some old documents available with S&T studies on subsidence.

Kevin Leary: He has a TIE paper on this from 1999.

Bryan Foley: Can we get access to the surface barrier data on the SCFA website?

Scott McMullin: Yes, go to the technical document area and do a keyword search. All the references in the guidance document are posted there.

Performance Monitoring at the Prototype Hanford Barrier – Curt Wittreich (CHI)

Background:

- Driven by the 200-BP-1 operable unit in the CERCLA process. Before a decision could be made, we needed performance data.
- Treatability Test Plan issued 6/93.
- Prototype Hanford Barrier constructed in FY94 over the 216-B-57 Crib. Constructability Report issued 10/94.
- Three-year treatability test of barrier performance under ambient and extreme precipitation (FY95 through FY97).
- One additional year of treatability testing in FY98 under ambient conditions at a reduced level..
- Four-year Treatability Test Report issued 8/99.
- Continued barrier monitoring since FY99 under ambient conditions at a reduced level based on treatability test recommendations.
- FY99-FY00 barrier monitoring results issued via annual letter report.

Barrier Monitoring Scope:

- Treatability Test Phase I – Constructability
- Treatability Test Phase II – Performance testing and monitoring
- Post –treatability test monitoring (focused on water balance, vegetation and animal use surveys, stability surveys).

Summary of Results:

- Hanford barrier easily constructed using standard equipment.
- Unit cost of Hanford barrier (excluding testing and monitoring) was $320/square meter
- Asphalt hydraulic conductivity 10^{-8} to 10^{-10} cm/sec
- Hydrologic performance (water balance)
    - Essentially no drainage through upper barrier silt layer
    - No measurable amounts of drainage through the asphalt layer
- Water and wind erosion
    - No measurable loss of soil from wind erosion
    - Minimal surface water runoff and no water erosion
- Plant growth
    - Vegetation established quickly and effectively removes water
- Biointrusion
    - Minimal small mammal burrowing activity with no impact on barrier performance
- Barrier stability
    - Barrier sideslopes and surface have remained stable.

There have been some unique observations on vegetation. Sagebrush is the preferred vegetation, and native grasses work well, too.

Path forward:

- Continue performance monitoring
- Material availability – important issue for project
- Asphalt barrier layer durability testing
- Full-scale performance testing of other graded barriers
- Water balance model for design optimization
- Hydrologic breakthrough data for silt loam

Scott McMullin: What is the projected plan for monitoring and who is funding it?
Curt: The minimal activity that must be maintained is funded by the Environmental Restoration Program.

Draft: Hanford Site Cleanup Strategy for Successful Implementation of Surface Barriers – Mike Fayer (PNNL)

Mike made this presentation for Mark Freshley of PNNL. We have a couple of pages of text based on a long history leading up to where we are now.

Strategy Prelude and Outline:

- Protective Barrier Program (mid-1980s to 1994)
- Treatability Study
- Integration Project: Geotechnical Symposium on Surface Barriers (2/29/00)
- FY 2001 Informal Discussions of Hanford Strategy
- Draft Strategy Outline – Background, Activities, Needs, Future Opportunities

Background:

- Number of barriers needed: 200 to cover more than 3.2 million square meters (not including CDI or large-area barriers)
- Quantity of material needed: 14 million cubic meters of materials needed for just the 200-Area environmental restoration sites
- Plans to date: DOE focused feasibility study calls for graded barrier approach
- Tests to date: Lysimeter/Field Tests initiated in 1987; Treatability Study initiated in 1994

Current Activities:

- ER Project to identify silt loam borrow site to support all Hanford Barrier needs
- ER Project to continue performance monitoring of the Prototype Surface Barrier
- EM-50 Project (TTP RL3-1-SS-20) to address barrier performance and monitoring issues

Surface Barrier Needs at Hanford:

- Full-scale performance tests of modified RCRA C design (highest priority)
- Design optimization tool to address performance, materials, and barrier dimensions to allow graded barrier approach
- Longevity evaluation of asphalt layer
- Hydrologic and stability evaluations of sideslope designs and alternative
- Long-term monitoring methods

Future Opportunities:

- 3 TTP Proposals to EM-50
  - Long-Term Cover Performance: Side Slope Modifications
  - Performance and Risk of Long-Term Covers
  - Determination of Long-Term Aging Properties of Asphaltic Barrier Materials
- ER Project to test silt loam borrow material and continue monitoring the Prototype Surface Barrier
- Surface Barrier Deployment
  - Combined EM-50 and ER project by FY 2004 to design, construct, test, and monitor a field-scale modified RCRA Subtitle C cover
  - Use design guidance and data produced by SCFA Long-Term Covers Program
  - ER Project planned for this deployment in their baseline with regulator and cross-project support
  - Hanford needs EM-50 support to make this deployment happen

Any feedback from this workshop will feed this effort.

Brainstorm New Opportunities to Accomplish Purpose and Objectives

This prototype challenge area workshop was successful because it brought all the end-user groups together to learn about each other's surface barrier planning activities. At this point, the group has the opportunity to determine the path forward for surface barrier implementation at Hanford. Should there be additional workshops or meetings? Who should be involved in this effort? Should we develop a strategic Site-wide schedule or roadmap for surface barriers? We need an integrated group of Hanford end-users to determine how the Site is going to implement surface barriers.

Scott McMullin summarized that the Hanford Site has surface barrier needs for canyon closure, tanks, and landfills/cribs. SCFA is focused on S&T needs from Hanford. A logical suggestion is that when the Hanford STCG has the needs meetings, they should also facilitate meetings with the Focus Areas.

Jim Honeyman: There is a series of activities occurring at this point related to our 200-Area closure strategy. But the reality is that we really don't have an integrated plan for it. What does it take to complete the cleanup job at Hanford? It will take a level of commitment from all Site end-users.

Terry Walton: When we built this workshop agenda, we provided an opportunity for feedback on whether we are doing the right things or if there is something missing.

Dennis Faulk: Fundamentally, the Site is on the right track, but there is a missing piece. Maybe we ought to build one of these other barriers so we have three choices.

Kevin Leary: Our challenge is to pull together a detailed roadmap with an integrated team that builds upon the guidance document that Scott McMullin has pulled together. We should update

the SCFA database with all the work that has been done on barriers and use that information in the roadmap.

Mike Fayer: Ours is an arid site problem, and Hanford should not be developing a roadmap on their own. It should be worked with all the arid sites in the DOE Complex. Financial resources and time are the big issues. The end product should be a Surface Barrier Implementation Roadmap for Arid Sites.

Dirk Dunning: We need to learn from past engineering mistakes that caused 85% of all RCRA barriers to fail. We should study EPA's history of what's worked, what hasn't, and why. The capillary barrier didn't do as well. We need lessons learned on how to modify the RCRA barrier to make it work better. Don't just look at what the surface barrier is in isolation.

Fred Mann: He echoed what Dennis Faulk said -- get on with it! The ILAW disposal facility was designed, including the cap. These integrated systems have effects on the ground, and we need input early rather than later because it's very expensive to change designs. These are engineered facilities. We need to look at failure modes and we need additional resources to do more engineering.

Dennis Faulk: We continue to revisit roadmapping. The information is already available. Get on with it!

Jim Honeyman -- The reality is that we need a continuing program where we do something and then reevaluate it and make improvements or do something else.

Scott McMullin – The logical technology insertion point is in the treatability phase. It might be worth going into existing projects to target their technology insertion points in terms of the schedule. Bureaucracy is getting in the way between TFA and SCFA.

Mike Fayer: We need to develop technologies for long-term performance monitoring.

Scott McMullin – We need to do an assessment of what's already being done, and then improve upon it.

Kevin Leary: Look at the probably of barrier failure and the associated risk. If the risk is high, we might have to change the design.

Fred Mann: We need to look at the surface barrier design and what it is protecting. We might need to make tradeoffs, but we need knowledge about how the barrier works.
Mike Schlender – That's a very good point.

Kevin Leary: We will need a brainstorming session later just to get ideas out of the box (i.e., not just barriers, but other potential solutions to the overall problems).

Dennis Faulk: We need to get to that discussion on what makes sense for different waste sites. It would be great to participate in that. There are 200 waste sites identified to date that might need barriers. What about the other 600?

Curt Wittreich: For long-range planning purposes, we had to make some decisions on which sites might need barriers.

Dirk Dunning: Using apatite on soils and immobilizing things is just one solution. The purpose is to protect the environment and human health, so we should also look at alternative options. What are the end conditions that we have to meet? Public involvement should be considered.

Bryan Foley: We need to produce an overlay of the Hanford Site that shows what types of barriers are needed where so we have something to look at. This would provide an aggregate picture of potential future barriers all over the Site. We should take on the opportunity of figuring out who wants to work on this.

Mike Schlender: On June 26, a workshop was held on developing a common vision for Hanford cleanup. There is a process that's been started, involving a broad spectrum of stakeholders and regulators. That group will continue to expand. Mike is trying to do the early staff work to get the primary parties aligned. He wants to come back and talk to the STCG about that. He also wants to capture STCG thoughts and bring them forward to his group. The goal is to bring all the stakeholders together to support the common vision. DOE is launching it with HAB awareness. Please send your comments, concerns, and issues to Mike to help shape where we're going. Leif Erickson from ORP is Mike's partner in this effort.

Scott McMullin: As an outcome of this meeting, we should turn these brainstorming results into bulleted actions so others could benefit from it.

Bryan Foley: We need to go to ORP to get their involvement.

Dennis Faulk: We should give Pete Knollmeyer our brainstorming results.

Marcus Glasper: Pete was one of the initial people who suggested that we move into these kinds of workshops. Marcus is not sure that this list would be helpful to Pete.

Terry Walton: To build on this, we didn't mention the fact that we are already gathered around the roadmapping process as a bridge between the S&T assessment and the Site baseline. Pete and others can be engaged in that effort.

Scott McMullin: If you categorize the commonalities and come up with 5-6 key action items, Pete could easily pick up on it.

Jeff Frey: Judging from the number of people who referenced commonalities, there has been a lot of integration going on in this workshop.

Bryan Foley: We will try to consolidate this list into 5-6 succinct nuggets. We might call on some people in this room to do that. Then Bryan will present the information to Pete.

Jim Honeyman: We should also capture what DOE's objective is so that we can do what makes sense in the projects.

Mike Schlender: What's the remedial action system? Think about the current state of knowledge. Is there a need for a follow-on meeting to discuss the 5-6 things on the list?

The next STCG Management Council meeting will focus on Groundwater Remediation.

Terry Walton wants feedback on whether this is the right kind of meeting, how well it went, and how you feel about it.

Kevin Leary: One possibility for improvement is to get the presenters together first so there's no overlap. Have more discussion and fewer presentations. Most attendees liked what we did today.

Dirk Dunning: One of the things that is important to remember is why we're doing this. Make sure we think about the ecological impacts.

Regarding whole-day meetings:
Craig Cameron: Half-day meetings are OK for updates, but for something like this, we need more time.

Frequency of workshops on the 11 technical challenges:
Jeff Frey: These workshops need to happen in support of the projects. They should respond to project needs rather than the STCG meeting schedule.

Mike Schlender: Consider cross-over issues between challenge areas.

Kevin Leary: Do the top challenges, and then see how they go.

Marcus Glasper: We'll see a new STCG website soon. The plan is to put the proceedings of these technical workshops on that website. Thanks to Scott McMullin for coming from Savannah River to attend this workshop.

Opportunities to Accomplish Workshop Purpose & Objectives

Key: Red = planning
Blue = operations
Green = S&T activities
Black = other

- Facilitate meeting between SCFA and TFA (and possibly TMFA and DDFA) to focus on barrier needs (Scott McMullin action)
- Focus on 200-Area closure strategy as an integrated Hanford team (involve all programs) – requires long-term commitment of all end users
- Build another barrier here (RCRA-D, graded approach) to allow 3 choices for the future
- Work with other arid sites to leverage funding; use data from others (arid sites roadmap)
- Develop a detailed roadmap with integrated team, building on guidance documents, update database of performance info.
- Study EPA history on RCRA barriers – what worked, what didn't, and why
- Look for lessons to modify RCRA-C barrier, consider system as a whole
- Move quickly with these actions (for ILAW)
- Look at system failure modes and ways to design around them
- Get on with it
- If things don't work, learn from mistakes and correct them
- Look at TIPs for target projects and develop a schedule for S&T activities
- Develop technologies for long-term performance monitoring
- Review ongoing efforts in monitoring and identify gaps
- Look at probability of barrier failure and associated risk (point of exposure)
- Look at trade-offs between modification of waste forms and barrier designs (look at waste disposal system as an integrated whole)
- Group brainstorming session to think outside the box (after failure mode analysis)
- Discuss what makes sense for different waste sites
- Look at alternative options to surface barriers (e.g., chemical injection)
- Develop an overlay of the site showing types of barriers proposed for various waste sites – aggregate picture
- Identify core team to work on this and get management commitment. Consider how to do public involvement (e.g., TWRS rebaselining process of public involvement)
- Provide input to Pete Knollmeyer for Central Plateau strategy (Bryan Foley action)
- Look at horizontal flow under barriers and into waste

Consolidated List

Planning (roadmapping effort)

Tasks:
Scheduling:
Functional activities (hodgepodge):

- Focus on 200-Area closure strategy as an integrated Hanford team (involve all programs) – requires long-term commitment of all end users
- Work with other arid sites to leverage funding; use data from others (arid sites roadmap)
- Develop a detailed roadmap with integrated team, building on guidance documents, update database of performance info.
- Study EPA history on RCRA barriers – what worked, what didn't, and why
- Look for lessons to modify RCRA-C barrier, consider system as a whole
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- Develop an overlay of the site showing types of barriers proposed for various waste sites – aggregate picture
- Identify core team to work on this and get management commitment. Consider how to do public involvement (e.g., TWRS rebaselining process of public involvement)

S&T Activities

- Look at system failure modes and ways to design around them
- Develop technologies for long-term performance monitoring
- Look at probability of barrier failure and associated risk (point of exposure)
- Look at alternative options to surface barriers (e.g., chemical injection)
- Look at horizontal flow under barriers and into waste

Operations

- Build another barrier here (RCRA-D, graded approach) to allow 3 choices for the future

Scott McMullin actions – workshop on failure modes (arid and non-arid)